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A synthesis of live fuel moisture and wildland fire and development of a national historical live fuel moisture database

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Project Title: A synthesis of live fuel moisture and wildland fire and the development of a national historical live fuel moisture database

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Executive Summary

Live fuels are a key component to the wildland fuel complex but little is know about their contribution to fire danger or fire behavior. This review attempts to quantify our current understanding of the role that live fuels play in combustion and how those characteristics are quantified into prediction systems that fire managers use to assess fire danger or fire behavior as well as how live fuel parameters for those systems are measured. We review how live fuels are incorporated into three fire danger and fire behavior prediction systems that have found widespread use throughout the world. We discuss the two primary methods used to characterize live fuels spatially, namely through field sampling and satellite proxy. Throughout, we seek to illuminate future pathways to research that may improve our understanding of the role that live fuels play in wildland fire. Finally, we present the development of a national historical live fuel moisture database and interface that will simplify data management and analysis for local units.

Live Fuel Moisture Review

The live fuel moisture review has been complete and a draft of the review paper to be submitted to a peer reviewed journal is provided as Attachment one. The review paper was successful in identifying our current state of understanding of the role that live fuels play in combustion, how they are incorporated into operational fire behavior / fire danger models and how important live fuel metrics are quantified using field sampling and remote sensing. It identifies inconsistencies in terminology and applications relating to live fuels in the peer-reviewed literature. It also attempt to identify some future pathways of research that would be fruitful to help improve existing decision support systems.

In addition to the review, a considerable amount of time was spent decomposing the current surface fire spread model into the component where live fuels are important. This sensitivity study was presented at an international fire and forest meteorology conference as well as to fire behavior practitioners through workshop formats. This work resulted in a peer-reviewed article in the International Journal of Wildland Fire (see deliverables table summary for reference).

Web-based Annotated Bibliography and Links to Scanned Documents
We have also published the references of the review paper as a web-based annotated bibliography:

(http://www.wfas.net/component/option,com_jombib/Itemid,78/)

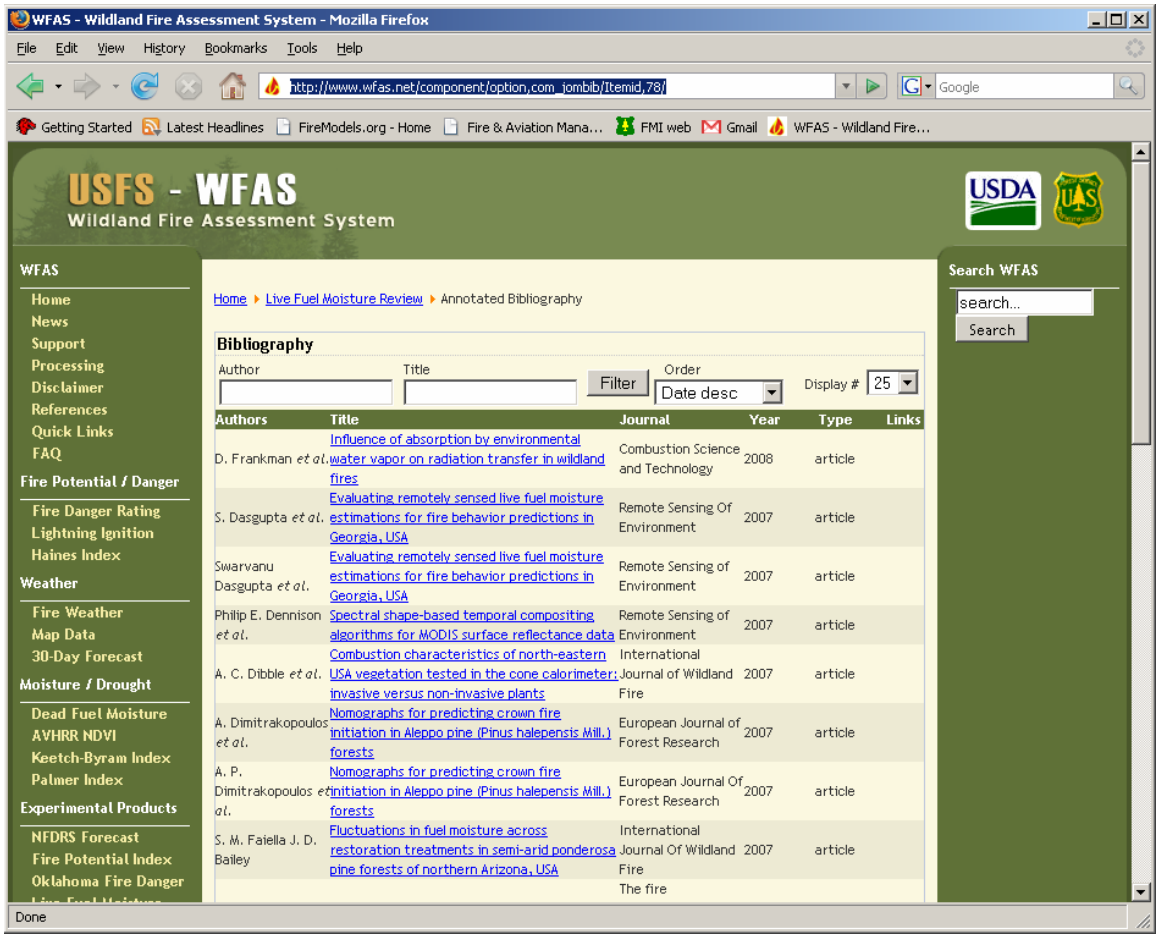

Figure 1 - Screen capture of the web-based annotated bibliography provided as part of this review on www.wfas.net.

The bibliography contains over 220 live fuel moisture references and also contains links to scanned copies dozens of historical research notes and station papers that are often difficult for researchers and practitioners to obtain.

Figure 2 - Example annotated reference from the live fuel moisture databaes. Scanned documents are linked at the bottom of each reference.

Historical Live Fuel Moisture Database

We collected live fuel moisture observations from local, state and federal agencies and we compiled those data into a single database. The database can be used to local agencies to track fuel moisture observations or it can be used by the research community to improve live fuel moisture models based on weather data or remote sensing. The user interface to the live fuel moisture database is shown in Figure 3. There are currently approximately 5500 live fuel moisture observations in the database from five agencies.

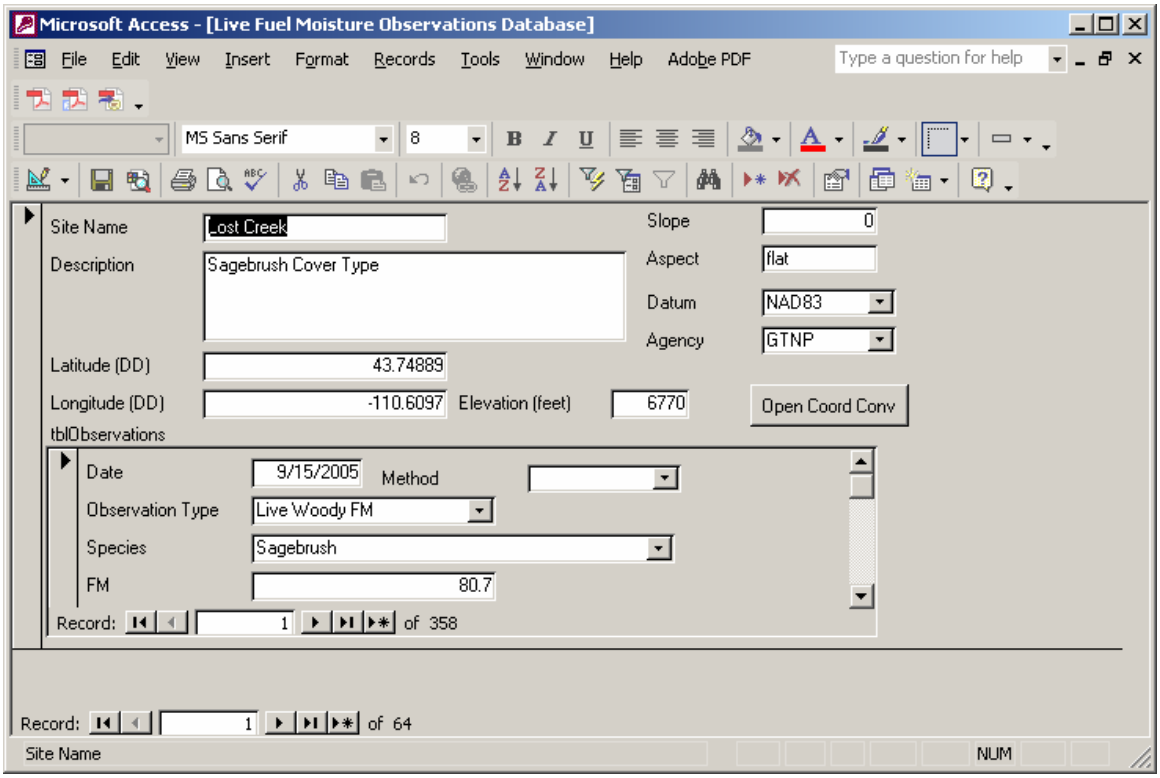

Figure 3 - Live fuel moisture database main menu.

Live Fuel Moisture Database Interface

We also developed a live fuel moisture interface that operates under the Windows operating system and connects to the Microsoft Access live fuel moisture observations database. The interface is similar in functionality to the commonly-used FireFamily Plus and thus users familiar with FireFamily will be able to use this interface quickly. The interface summarizes data over periods of interest and facilitates graphing to time series data that are often discontinuous. This is generally a very difficult task in an external program and is greatly simplified with this interface. We have also developed a QuickStart user guides to aide in the use of the program.

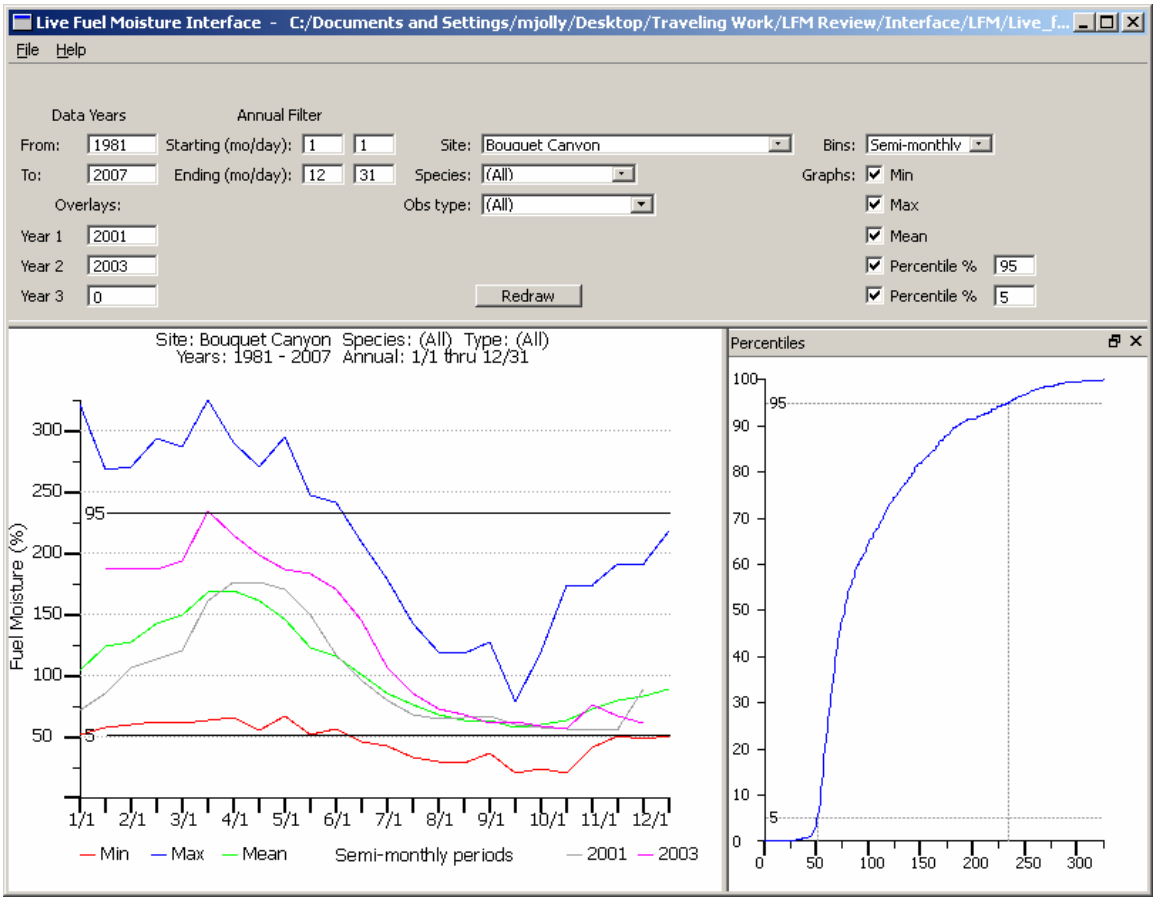

Figure 4 - Screen capture of the live fuel moisture database interface program showing time series graphs and percentile plots of live fuel moisture observations for a site in Southern California over the period 1981 to 2007.

Original Proposed Deliverable	Accomplished / Status
Web-based annotated bibliography	Available on: http://www.wfas.net under the Ongoing Research → Live Fuel Moisture Review menu options
Historical papers available online	Hyperlinked to papers in the web-based annotated bibliography on http://www.wfas.net
Synthesis paper	**Conference and Outreach Presentations** Jolly, WM. 2005. Sensitivity of a fire behavior model to changes in live fuel moisture. Presented at the Sixth Symposium on Fire and Forest Meteorology, Oct. 25-27, 2005, Canmore, AB, Canada. Jolly, WM. 2006. Sensitivity of a fire behavior model to changes in live fuel moisture. Presented at the Northern Rockies Fire Behavior Workshop. Jolly, WM. 2007. Fuel models in BehavePlus. Bureau of Indian Affairs, Northwest Region, Prescribed Fire Workshop. Jolly, WM. 2007. Sensitivity of a fire behavior model to changes in live fuel moisture. National Wildfire Coordinating Group, Fire Use Working Team. **Conference Proceedings** Jolly, WM. 2005. Sensitivity of a fire behavior model to changes in live fuel moisture. In the proceedings of the Sixth Symposium on Fire and Forest Meteorology, Oct. 25-27, 2005, Canmore, AB, Canada. **Peer-Reviewed Publication** Jolly, W. M. 2007. Sensitivity of a surface fire spread model and associated fire behaviour fuel models to changes in live fuel moisture. International Journal Of Wildland Fire 16:503-509.

	Review Paper Draft version to be submitted to International Journal of Wildland Fire presented as Attachment 1 to this final report and included on CD#1.
Historical live fuel moisture database	Assembled database of over 5500 fuel moisture observations from state and federal agencies across the Unites States. Copy of the database is included in CD#1.
Historical live fuel moisture database interface	Developed a computer program to interface to the live fuel moisture database. Program summarizes and plots data over any number of potential summary variables and greatly facilitates the display and analysis of field-collected live fuel moisture data. A copy of the program installer is provided with CD#1. A QuickStart User Guide for the program was also developed and is also provided on CD#1.